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VOLCANOES AND GLOBAL CATASTROPHES. Tom Simkin, Smithsonian Institution NHB, stop 119, Washington, D.C. 20560

An imcomplete review of the literature bearing on this conference suggests that many "players in the game" seem to regard it as a winner-take-all sweepstakes. The search for a single explanation for global mass extinctions has let to polarization and the controversies that are often fueled by widespread media attention.

The historic record shows a roughly linear log-log relation between the frequency of explosive volcanic eruptions and the volume of their products. Eruptions such as Mt. St. Helens 1980 produce on the order of 1 km^3 of tephra, destroying life over areas in the 10^{1-2} km^2 range, and take place, on the average, once or twice a decade. Eruptions producing 10 km^3 take place several times a century and, like Krakatau 1883, destroy life over 10^{2-3} km2 areas while producing clear global atmospheric effects. Eruptions producing 10^4 km^3 are known from the Quaternary record, and extrapolation from the historic record suggests that they occur perhaps once in 20,000 years, but none has occurred in historic time and little is known of their biologic (or atmospheric) effects. Even larger eruptions must also exist in the geologic record, but documentation of their volume (not to mention their effects) becomes increasingly difficult as their age increases.

The conclusion is inescapable that prehistoric eruptions have produced catastrophes on a global scale: only the magnitude of the associated mortality is in question.

Differentiation of large magma chambers is on a time scale of thousands to millions of years, and explosive volcanoes are clearly concentrated in narrow belts near converging plate margins. Over 94% of all historic eruptions come from less than 0.6% of the earth's surface, and the number of currently active magma chambers exceeds 1000. Slowly differentiating magma chambers must spend long time periods poised in a highly charged state and vulnerable to external triggering. The stresses of fortnightly earth tides have been enough to trigger eruptions in many documented cases, and poorly-understood plate interactions appear to have caused linked eruptions in the recent past (1835 Andes, 1902 West Indies). Tectonic plate-boundary processes may well trigger the simultaneous eruption of many poised magma chambers, making the global effects of linked major eruptions cumulative. Furthermore, a major impact event would be expected to trigger eruptions from many chambers, particularly if near a volcanic belt, adding volcanic amplification to the immediate effects of impact.

The "players in the game" cannot dismiss volcanism as a producer of global catastrophes. It's role in major extinctions is likely to have been at least contributory and may well have been large. More attention should be paid to global effects of the many huge eruptions in the geologic record that dwarf those known in historic time.